MOTOTRBO™

Text Messaging ADK Guide

Version 01.01

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REVISION HISTORY

Version	Date	Section	Page	Lines	Description
01.01	3/25/2008	2.4	11	147-164	Added information for interfacing to a Non-IP Peripheral
		2.5	11-13	165-203	Clarified use of Presence Notifier vs 3rd Party ARS application for Presence Services
		5	19	331-334	Clarified usage of "Forward to PC" provisioning in CPS.
		6	21	378-379	Added information regarding Supported Destinations for the Addressing Schema.
		8	25	432-464	Added guidelines for Subject Line Retention feature.
		9.4	29	495	Updated figure for TMS Direct Send Success – ARS Name Resolution message is not applicable.
		N/A	N/A	N/A	Removed guidelines regarding "TMS Acknowledgement (Failure)" – this message type is not supported.

TABLE OF CONTENTS

1 Overview

This document provides the architecture of the MOTOTRBO™ Text Messaging Service (TMS) and data interface to the TMS. The following are the major chapters of this document:

- Overview of the TMS architecture
- TMS Functionality offered by the MOTOTRBO™ radio
- Data interface and Presence interface description to the external TMS application
- Customer Programming Software (CPS) provisioning of the TMS

1.1 Purpose

This document is intended to be used by a third party developer to create external TMS applications that integrate with the MOTOTRBO™ radio. It provides the system level details of the main TMS components. It also provides information on the interoperability between the functions provided by the TMS and its components.

1.2 Assumptions

It is assumed that the reader of this documentation has the following domain knowledge:

- Principles of two-way radio communications
- Procedural or Object-Oriented Programming
- Transmission Control Protocol / User Datagram Protocol (TCP / UDP)
- Internet Protocol (IP)
- Universal Serial Bus (USB)

The following domain knowledge is considered beneficial, but is not required:

- Open Systems Interconnection (OSI) Model

1.3 References

[1] MOTOTRBO™ Text Messaging Protocol Specification
[2] MOTOTRBO™ Data Services Overview
[3] MOTOTRBO™ Option Board ADK Guide
[4] MOTOTRBO™ XCMP / XNL Development Guide
[5] MOTOTRBO™ Presence Notifier to Watcher Interface Specification
[6] MOTOTRBO™ ARS Specification ADK Guide

1.4 Terminology

Application Layer (OSI Layer 7) - this layer supports application processes.

Big Endian - an order in which the "big end" (most significant value in the sequence) is stored first (at the lowest storage address). For example, in a big-endian computer, the two bytes required for the hexadecimal number 4F52 would be stored as 4F52 in storage (4F at address 1000, 52 at 1001).

Broadcast - an unsolicited message that is sent to one or more recipients.

CDC-ACM – Communications Device Class-Abstract Control Module

Confirmed Delivery Channel - any communications channel that provides confirmation to the sender when the receiver receives its data correctly.

CR – carriage return (0x0D00), UCS2-LE formatted.

Data Link Layer (OSI Layer 2) - this layer encodes and decodes the data packets. It furnishes transmission protocol knowledge.

Direct Routing – it is used when the source and destination addresses have the same network number, the packet must not be forwarded.

Indirect Routing – it is used when the source and destination addresses do not have the same network number, the packet must be forwarded by a node that knows how to reach the destination.

IPv4 – Internet Protocol version 4

LF – line feed (0x0A00) , UCS2-LE formatted.

Little Endian - an order in which the "little end" (least significant value in the sequence) is stored first. For example, in a little-endian computer, the two bytes required for the hexadecimal number 4F52 would be stored as 524F (52 at address 1000, 4F at 1001).

MAC – Media Access Control

Network Layer (OSI Layer 3) - this layer provides routing and forwarding services. It creates logical paths, known as virtual circuits, for transmitting data from node to node.

Open System Interconnection (OSI) – a model which defines a networking framework for implementing protocols in seven layers. Control is passed from one layer to the next, starting at the top layer in one station, and proceeding to the bottom layer, over the channel to the next station, and back up the hierarchy.

Packet - a block of transmitted data.

PC – Personal Computer.

Physical Layer (OSI Layer 1) - this layer conveys the bit stream (e.g. electrical impulse, light or radio signal) through the network at the electrical and mechanical level. It provides the physical means of sending and receiving data.

Presentation Layer (OSI Layer 6) - this layer formats and encrypts data to be sent across a network, providing freedom from compatibility problems.

Reply - a message that is sent in response to a Request message.

Request - a message that expects an immediate reply

Reliable Channel - any communications channel that provides a mechanism to detect and optionally correct an error in data received over the communications channel. Some errors may not be possible to detect or correct. A reliable channel simply provides more reliability above and beyond an unreliable communications channel.

Response - a message that is sent as result of a previous message. A response could be a reply or broadcast message

RF – Radio Frequency.

Session Layer (OSI Layer 5) - this layer establishes, manages and terminates connections between applications.

Simple Mail Transfer Protocol (SMTP) – a protocol for sending e-mail messages between servers.

SUID – Subscriber Unit ID

Transport Layer (OSI Layer 4) - this layer provides transfer of data between hosts.

TGID – Talk Group ID

UCS-2 LE – Universal Character Set coded in 2 bytes with Little Endian byte order.

Unreliable Channel - a communication channel that provides no means for a receiver to detect communication errors.

XCMP – Extended Control and Management Protocol.

XNL – XCMP Network Layer.

2 Text Messaging Service Architecture

2.1 Overview

The MOTOTRBO™ radio provides a User Datagram Protocol (UDP) port through which an external PC application may communicate using the Text Messaging Service (TMS) protocol. This protocol is used to transport simple text messages between a PC-based application and one or more MOTOTRBO™ subscribers. Please note that the TMS is only available when the MOTOTRBO™ radio is operating in digital RF mode.

Additionally, the TMS may be accessed as part of an integrated feature set provided by an option board-based application. Please see References [2] and [3] for more details.

Figure 1 shows the architecture diagram for a typical configuration for Text Messaging between a radio-attached PC application as well as some other MOTOTRBO™ Subscriber Unit (SU) in the Radio Network.

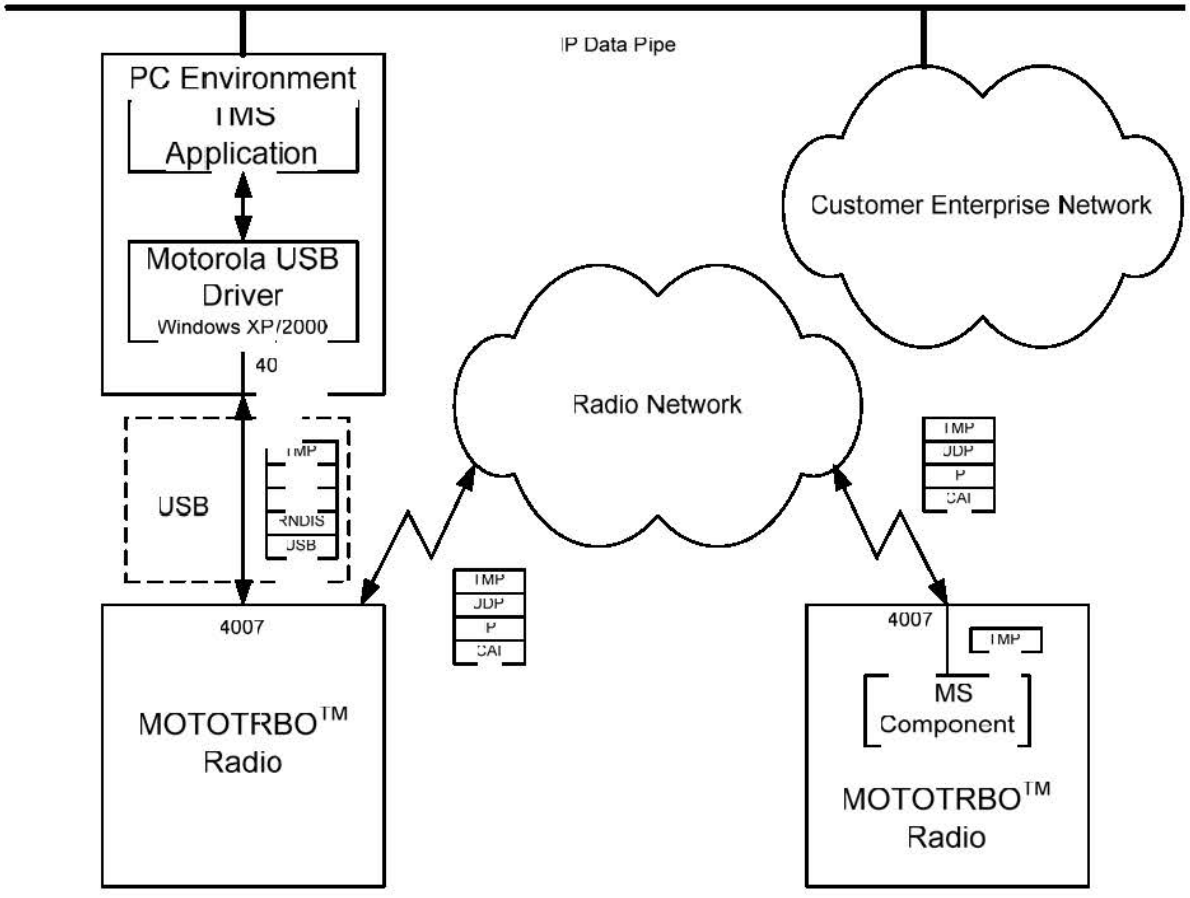

Figure 1 – Text Messaging Service Interface Architecture

In this architecture, the TMS application shown in this diagram can be some stand-alone PC application or some client-server application that interfaces with a

MOTOTRBO™ radio in order to transport text messages through the radio's Common Air Interface (CAI). For radio network bandwidth efficient operation, the TMS application may interoperate with a Presence Notifier (PN) in order to be informed of the registration / de-registration of subscriber units. See section 2.4 for more information.

Please note that specific Customer Programming Software (CPS) provisioning is required in order to ensure proper TMS operation as depicted in Figure 1. Please see section 5 for more information on CPS programming.

2.2 Interface to Text Messaging Service Application

For a PC-based TMS application, the PC will be physically connected to a MOTOTRBO™ radio though a USB connection.

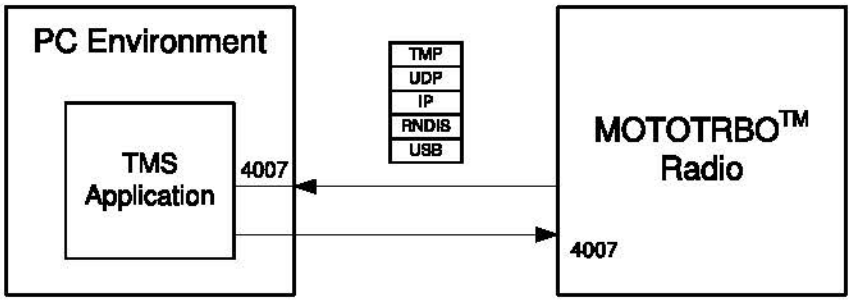

Figure 2 – Interface between External TMS Application and MOTOTRBO™ Radio

UDP / IP are used as the transport and network layers for communication between the PC-based TMS application and the TMS component in the radio. Both the radio and PC-based application listen on UDP port 4007 for Text Messaging Protocol (TMP) messages. These TMP messages are in turn sent by the locally attached radio (acting as a data modem) to other MOTOTRBO™ subscriber units. The target radios are addressed in the UDP packet by IP address and port number (4007). The specified IP address can address an individual subscriber unit or a group of subscriber units. The UDP port 4007 can be configured to a different number through CPS if there is a port number conflict.

2.3 Interface to Option Board

For TMS integration with an option board-based application, the MOTOTRBO™ radio provides a proxy service through which the option board can send and receive UDP / IP packets. UDP port 4061 is reserved for option board use of the TMS. The option board uses XCMP / XNL over the Synchronous Serial Interface (SSI) to communicate with the proxy service. Specifically, an XCMP data session is used to transfer data between the option board and the TMS proxy. Please see References [2] and [4] for more information.

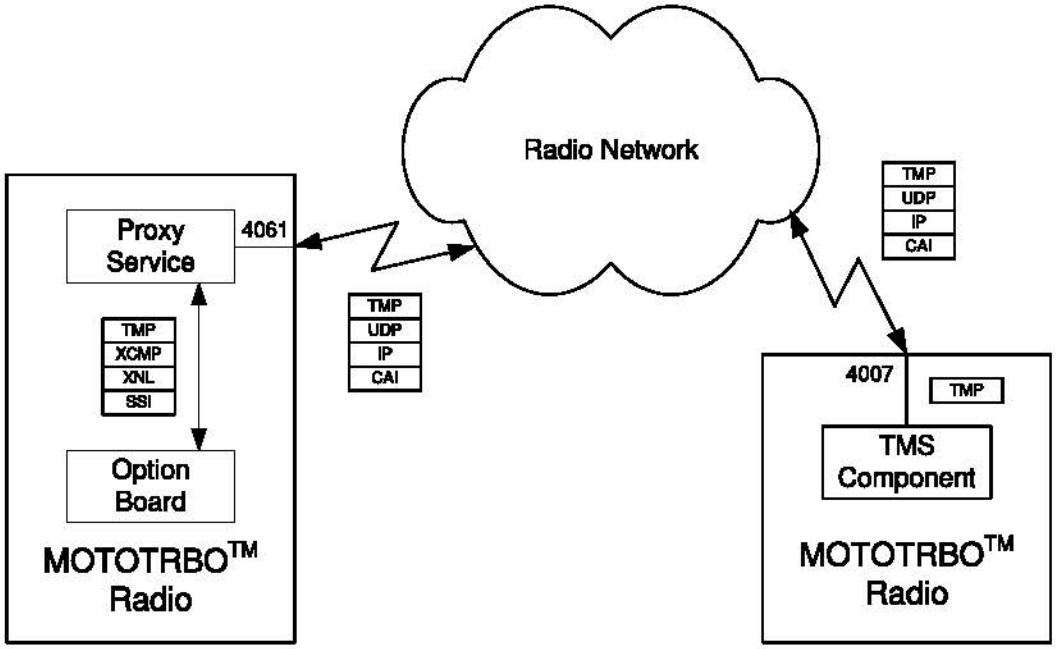

Figure 3 – Interface between Option Board and MOTOTRBO™ Radio

To send a text message from the option board to some other MOTOTRBO™ subscriber in the radio network, the option board formats the text message with the IP address and UDP port number (4007) of the target subscriber. The target subscriber can be another MOTOTRBO™ radio or a PC-attached MOTOTRBO™ radio. The text message is routed to the proxy service as a XCMP data session. The radio forwards the text message over-the-air as a UDP payload with source port number set to the option board's text messaging proxy port (4061) and destination port number set to 4007 for the target subscriber.

This process is reversed when an option board-integrated MOTOTRBO™ radio receives a text message from some other subscriber in the radio network.

2.4 Interface to Non-IP Peripheral

For TMS integration with a non-IP peripheral-based application, the MOTOTRBO™ radio provides a proxy service through which the non-IP peripheral can send and receive UDP / IP packets. UDP port 4066 is reserved for non-IP peripheral use of the TMS. The non-IP peripheral uses XCMP / XNL over CDC-ACM / USB to communicate with the proxy service. Specifically, an XCMP data session is used to transfer data between the non-IP peripheral and the TMS proxy. Please see References [2] and [4] for more information.

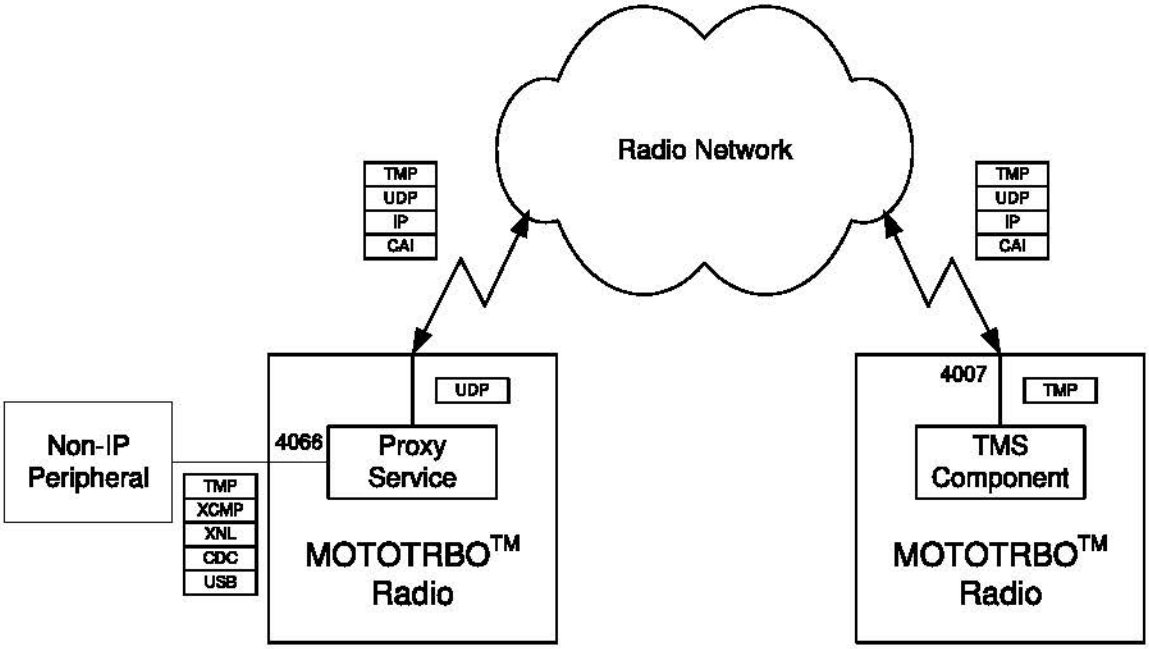

Figure 4 – Interface between Non-IP Peripheral and MOTOTRBO™ Radio

To send a text message from the non-IP peripheral to some other MOTOTRBO™ subscriber in the radio network, the non-IP peripheral formats the text message with the IP address and UDP port number (4007) of the target subscriber. The target subscriber can be another MOTOTRBO™ radio or a PC-attached MOTOTRBO™ radio. The text message is routed to the Proxy Service as a XCMP data session. The radio forwards the text message over-the-air as a UDP payload with source port number set to the non-IP peripheral's text messaging proxy port (4066) and destination port number set to 4007 for the target subscriber.

2.5 Interface to Presence Services

Presence Services can be used in conjunction with a TMS application to efficiently utilize the Radio Network bandwidth. Presence Services may be added to the Customer Enterprise Network (CEN) through the use of the MOTOTRBO™ Presence Notifier (PN) or a 3rd party Automatic Registration Service (ARS) application. Please note that

Presence Services is only available when the MOTOTRBO™ radio is operating in digital RF mode. Please see Reference [5] and Reference [6] for more information.

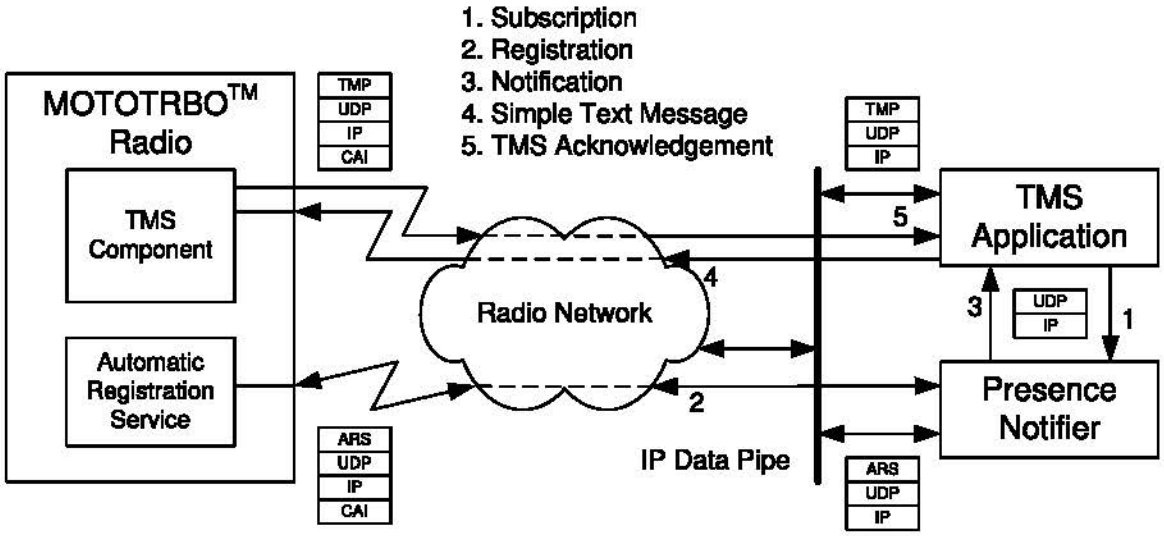

Figure 5 – Interoperability with Presence Notifier

Figure 5 shows the interaction of the MOTOTRBO™ PN with a TMS application. The PN accepts radio presence information, stores it, and then distributes it to a TMS application that subscribes to receive presence notification. The intent of Presence Services is to allow radios to announce their availability within the Radio Network to applications existing in the CEN. The presence information of a MOTOTRBO™ radio is useful when an application needs to send a message to the subscriber unit asynchronously and results in efficient bandwidth utilization of the Radio Network. Please see section 4 for more information on the Presence Notifier.

Please note that the ARS protocol does not have a mechanism to provide a status change when a subscriber unit temporarily leaves the area of coverage. Also, the presence status of a subscriber unit may be incorrect if powered off in an unexpected manner (e.g.. loss of power, low battery, etc.). The Presence Service is comprised of two components:

1. Automatic Registration Service (ARS) – Located in the MOTOTRBO™ radio. On radio power on as well as periodically and upon re-entry into digital RF mode, ARS registers the radio with the Presence Services application (MOTOTRBO™ PN or 3rd Party ARS application). ARS will also de-register the radio from the Presence Services on power off.

2. MOTOTRBO Presence Notifier (PN) / 3rd Party ARS Application – Located in the Customer Enterprise Network (CEN). A TMS application subscribes with the Presence Services application (MOTOTRBO™ Presence Notifier or 3rd Party ARS application) to be informed of the presence events of specific radios. On the

change in status (i.e. presence to absence or absence to presence) of any particular radio, the Presence Services application sends a notification to the TMS application. The notification will contain the IPv4 address of the MOTOTRBO™ radio. A Presence Services application may co-exist with a TMS application in same PC environment. However, use of the MOTOTRBO™ Presence Notifier or a 3rd Party ARS application is mutually exclusive within the same CEN.

3 Text Messaging Operations Offered

This section briefly describes the text messaging functionality available in the MOTOTRBO™ radio. These functions are divided into two categories: (1) Gateway / Server operations and (2) Client / Subscriber operations. Please see Reference [1] for more information.

3.1 Gateway / Server Operations

These operations are not supported directly by any MOTOTRBO™ subscriber unit and can only be initiated by a PC-based application attached to the radio. The operations in this category are used by a PC application that is acting as a gateway to another enterprise network and / or acting as a server for enhanced text message delivery. Gateway / Server operations include:

- TMS Service Availability – Announces availability of a TMS gateway or server on the Radio Network. May also provide expanded information indicating what gateway services are available. This message is sent to each subscriber unit that registers onto the Radio Network. Normally used in conjunction with Presence Notification. Please see Reference [5] for more information.

3.2 Client / Subscriber Operations

These operations are supported directly by all MOTOTRBO™ subscriber units. Any PC-based application functioning as a peer to any subscriber unit within the Radio Network must also support these operations. Client / Subscriber operations include:

- Simple Text Message – Delivers a text message to an individual user or a group of users. Confirmed delivery may be used with an individual message but is not required. Confirmed delivery is not recommended for group messages in order to minimize air resource bandwidth / contention issues.

By default, the PC-based application must send less than 14 text messages per minute per channel to avoid channel overload. This number is a default value and maybe decreased or increased based on system usage and the number of channels available. However, the application may be unaware of the channel upon which the message is sent. Therefore it can not be guaranteed that a particular channel won't be overloaded if the default is increased in a multi-channel configuration. The PC-based application must implement its own mechanism for "flow control" in all possible conditions.

Also, the minimum interval between two consecutive messages from the PC-based application to the attached radio must be 1200ms per channel.

During scan operation, the TMS of the radio will temporarily suspend the scan in order to send or receive text messages. Upon completion of text protocol communication, scan operation will resume. Please note that the transmission or reception of the text protocol messages will only occur on the radio's home channel. And the voice communication always has higher priority than the text protocol communication.

If the target subscriber unit is in a voice call, the source subscriber unit will start a timer to wait for the channel to be free. If the channel is free before the timer expires, the message will be sent to the target subscriber unit.

3.3 Message Acknowledgement

With the exception of unconfirmed delivery of Simple Text Messages, all other operations have a corresponding acknowledgement.

- TMS Service Availability Acknowledgement – Sent by a subscriber unit or radio-attached PC in response to a TMS Service Availability message following registration onto the Radio Network.

- TMS Acknowledgement (Success) – Sent by a subscriber unit or radio-attached PC to positively acknowledge receipt of a text message. Should only be sent if the Simple Text Message requires confirmed delivery.

There are sequence number fields in the Simple Text Message and TMS Acknowledgement, which are used to match the acknowledgement with the original Simple Text Messages.

When acknowledgement is required, an Acknowledgement Reply Timeout Timer at the application layer must be no less than 70 seconds.

For both TMS Service Availability and Simple Text Message if acknowledgement is required and the sender does not receive the acknowledgement within predefined time period, the TMS Service Availability or Simple Text Message may be retransmitted with the same sequence number. See Figure 14 for more details.

4 Presence Interface for External TMS Application

This section describes the Presence Notifier (PN) interface for an external TMS application running on a PC. Please note that use of the PN is optional. However, integrated operation with the PN will result in efficient bandwidth utilization of the Radio Network.

Presence information is provided to an external TMS application that subscribes to receive presence notifications for any one MOTOTRBO™ radio. The transport protocol between the TMS application and the PN is UDP / IP. The TMS application must support a mechanism for configuration of the IPv4 address of the PN. On receipt of a subscription, the PN responds with the presence state and, if available, the IPv4 address of the radio.

The PN communicates with the Automatic Registration Service (ARS) component located in the radio using UDP / IP. The UDP port address of the ARS is 4005. A MOTOTRBO™ radio registers itself to the PN using the PN's IPv4 address that is provisioned with the Customer Programming Software (CPS). Since the Radio Network may have more than one PN, it is not necessary for all subscriber units to register with the same Presence Notifier.

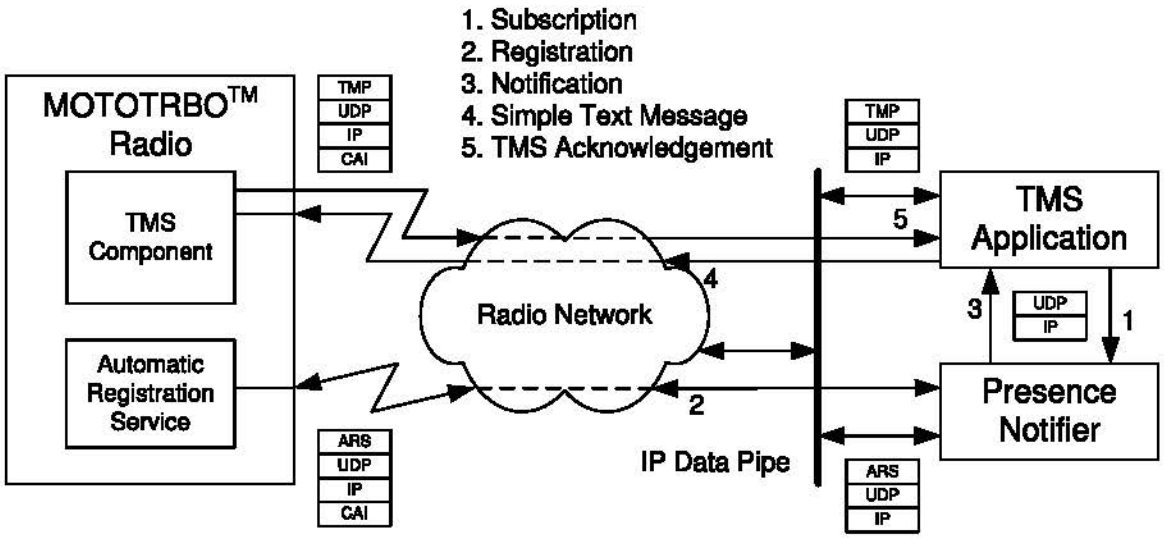

Figure 6 – Interoperability with Presence Notifier

If the Automatic Registration Service is enabled in a MOTOTRBO™ radio, then the radio will register, at power on and periodically during operation, with the Presence Notifier. The radio also registers every time it re-enters the Radio Network (e.g. transition between analog RF and digital RF modes). In addition, upon power off, the radio de-registers with the PN. On successful registration by the subscriber unit, the PN will respond with an acknowledgement; no acknowledgement is sent for de-registration. The radio may make up to 5 total attempts to receive acknowledgement of its registration attempt. If acknowledgement is still not received, then registration is attempted every 30 minutes until acknowledged.

When a subscriber unit successfully completes automatic registration, the PN status of the radio is "present". If the subscriber unit fails to complete automatic registration at any point in time, the PN status of the radio becomes "absent."

Please note that successful registration remains valid with the PN for a specified duration. The expiration time is PN configurable with a default value of 4 hours. Upon expiration of the registration period, the MOTOTRBO™ radio will re-register with the PN. For those radios that successfully re-register and for those that don't, the PN notifies any TMS application with subscriptions corresponding to the radios of interest with the updated presence state.

The PN stores the presence state of each MOTOTRBO™ radio in persistent memory. Therefore, on startup, the PN uses the stored data to query only those radios whose registration has not expired. For any radio that fails to respond to the query, the PN updates the presence state to "absent" and notifies any TMS application with corresponding subscriptions accordingly. Please note that the Presence Notifier is not able to recover the presence state of a radio that powered on and whose last known state was "absent" while the Presence Notifier was off.

To prevent catastrophic failure of the PN and any loss of presence states during "brown-out" or "black-out" conditions, it is recommended that the Presence Notifier's PC environment operate with an Uninterruptible Power Supply (UPS).

Please note that the Radio Information of any MOTOTRBO™ subscriber unit cannot be removed from the PN database once it is added.

4.1 Capacity of the Presence Notifier

The Presence Notifier is capable of storing states and radio information of up to 400 subscriber units and up to 10000 subscriptions from up to 25 applications. Note that it is not necessary to send an individual subscription for each radio. A list of radios (including a list of all radios) may be sent in the subscription request. A list of radios correspondingly reduces the total number of remaining subscriptions.

The PN is capable of up to 64 subscriptions (and resulting notifications) per second when running on a PC with at least a 1GHz processor clock. Please note that a subscription may result in multiple notifications sent by the Presence Notifier.

The PN is capable of up to 4 registrations per second from radios on a PC having at least a 1GHz processor clock. Please note that a registration may result in multiple notifications sent by the Presence Notifier.

4.2 Interface Details

Please see Reference [5] for more information.

5 CPS Provisioning

In order to route all the individual and group text messages through the MOTOTRBO™ radio (typically a mobile radio) to the local PC-based TMS application, the Network options of the radio must be configured for "Forward to PC" operation.

When "Forward to PC" is checked, both individual and group text messages will be forwarded to the PC. When "Forward to PC" is not checked, individual text messages targeted for the PC will be routed to the PC. Group text messages and individual text messages targeted for the radio will be routed to the radio.

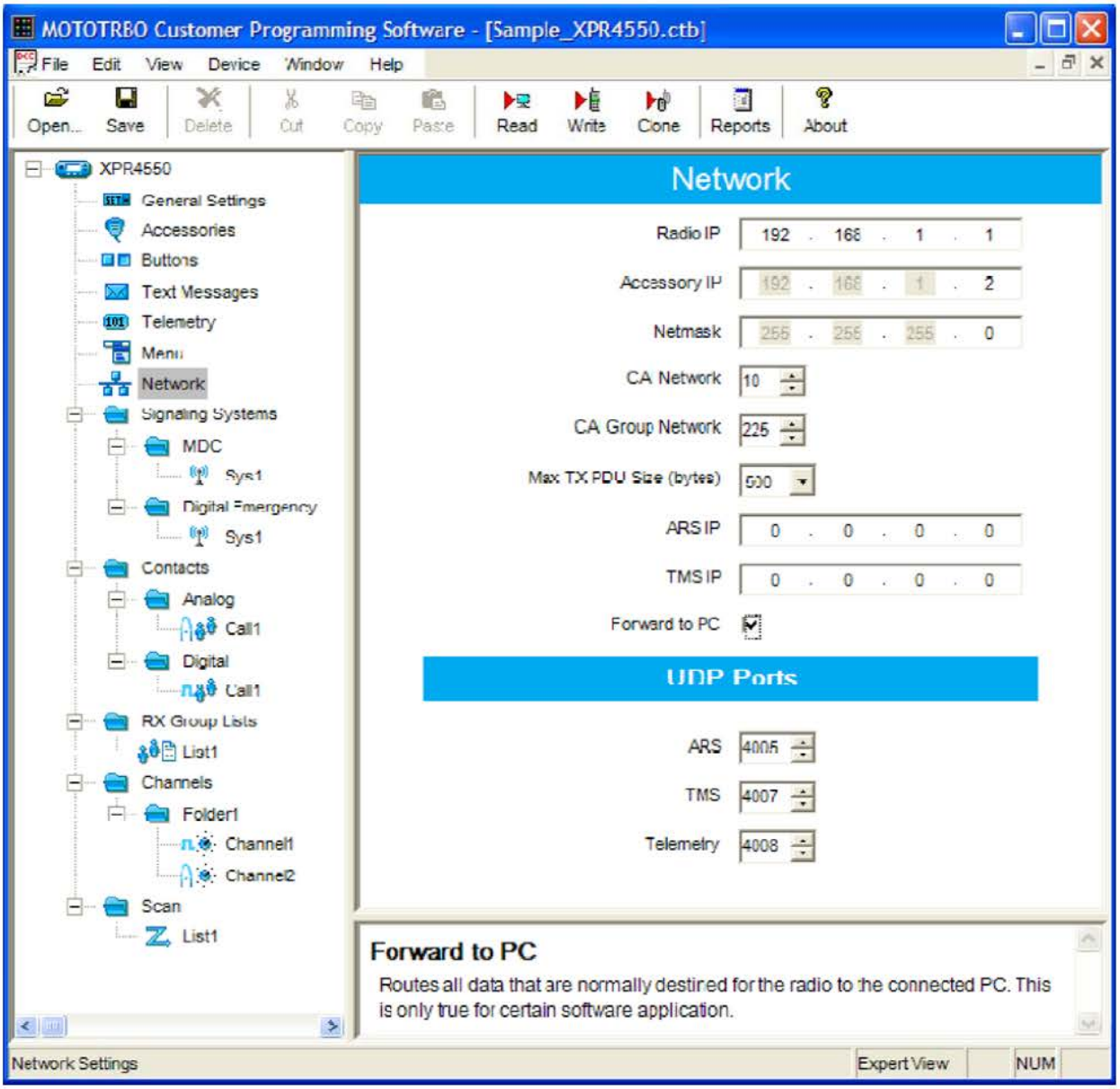

Figure 7 – Radio-Wide Provisioning for "Forward to PC" Operation

6 Application Address

In all of the Text Messaging message structures, there is an application address. It is used to support Enhanced PC-Based Text Messaging which includes sending messages to a Dispatcher client or to an external network address, and therefore involves the indirect addressing through the TMS Gateway.

For messages sent from the radio network to an external network, the application address field indicates the destination address to the TMS Gateway. For messages received inside the radio network that originated from an external network, the TMS Gateway will supply the source address to the receiving device using the application address field.

The addressing schema for devices in the radio network has the following format:

<objectID.type@domain>.

- The objectID for a device will be its layer 2 ID (individual or talk group). Dispatch clients located on the customer enterprise network have a unique name for an object ID.
- The type codes are parsed from the end of each address and are used for the following reasons:
  - To indicate to the subscriber unit how to address a message. The subscriber unit can associate a type with a direct or indirect routing address when sending a message.
  - To indicate to the TMS Gateway how to locate the destination for indirect routing. A message from the radio network that is destined to a Dispatch client type code will be routed properly by the TMS Gateway. A message from the radio network that is destined to an external address type code will be translated and routed by the TMS Gateway to an email server
  - To allow the differentiation between the individual ID and the talk group ID. The TMS Gateway will know how to determine if the destination IP address is for an individual subscriber unit or for a talk group based on the type code
- The domain name is obtained by the TMS Gateway from an email server. It is unknown to the radio network.
- The domain name must be used for external network address. Therefore when sending to the TMS Gateway from inside the radio network, the address will have the external network type appended at the end (i.e. username@domain.6 <mailto:username@domain.6>). Upon translation, the TMS Gateway will remove the type code. When receiving an email from an external network address, the TMS Gateway will append the type code before routing into the radio network.

Table 1 shows the addressing schema assignment in MOTOTRBO™ radio system. The Routing column indicates what mode is used for a message sent from a device inside the radio network to the device shown under the Receiving Object column.

Receiving Object		ObjectID	Type Code	Routing	Supported Destinations
Internal Network	Device (SU or PC)	SU's layer 2 ID	1	Direct	Radio or External Application
	Talk Group	Talk group layer 2 ID	2	Direct	
	Dispatcher(s) (client)	A name	4	Indirect	
External Network	External Network Address	username@domain	6	Indirect	External Application

Table 1 – MOTOTRBO™ Addressing Schema

The following are the rules for the use of the application layer address in the MOTOTRBO™ radio:

- Messages originating from a device (SU or Talk Group) to another device (SU or Talk Group) will NOT use the application layer address field. Addressing will reply on the underlying layers for the source and destination of the message.
- Messages originating from a device (SU or Talk Group) to an indirect routing type code will use the application layer address field for the destination address. The underlying layers will be addressed to the TMS Gateway.
- A message received by a device with the application layer address empty will use the underlying layers to identify the source address.
- A message received by a device with an application layer address present will use that to identify the source address.

Table 2 is a summary for what addressing is used in each case. Messages that are indirect routing show the first hop addresses (to TMS Gateway) and the second hop addresses (to the destination) separated by a dashed line. The parenthesis next to the Layer 7 (L7) address indicated whether the application layer address field is the destination address (to TMS Gateway) abbreviated as “dest” or the source address (to the destination) abbreviated as “src”.

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		RECEIVING OBJECT		
		SU or PC	**Dispatcher Client**	**External Network**
SENDING OBJECT	**SU or PC**	L7: L3: derived IP L2: SUID or TGID	L7: username.4 (dest) L3: TMS Gateway IP L2: SUID --- L7: SUID.1 (src) L3: Dispatcher Client IP L2: MAC	L7: username@domain.6 (dest) L3: TMS Gateway IP L2: SUID --- SMTP or other
	Dispatcher Client	L7: SUID.1 or TGID.2 (dest) L3: TMS Gateway IP L2: MAC --- L7: username.4 (src) L3: derived IP L2: SUID or TGID	L7: username.4 (dest) L3: TMS Gateway IP L2: MAC --- L7: username.4 (src) L3: Dispatcher IP L2: MAC	L7: username@domain.6 (dest) L3: TMS Gateway IP L2: MAC --- SMTP or other
	External Network	L7: SUID.1@domain or TGID.2@domain (dest) L3: IP routing L2: MAC routing --- L7: username@domain.6 (src) L3: derived IP L2: SUID or TGID	L7: username.4@domain (dest) L3: IP routing L2: MAC routing --- L7: username@domain.6 (src) L3: Dispatch IP L2: MAC	Not applicable

400 **Table 2 – Application Address Summary**

401 **NOTE:** For the interface between the Dispatcher client and the TMS Gateway, the
402 address fields indicate the intended content, but not necessarily the intended format.

7 Character Display

This section provides overview information about the character display on the MOTOTRBO™ radio.

The MOTOTRBO™ radio will truncate any received text message destined to its TMS component that is over 140 characters (280 bytes) before the message is displayed on the subscriber unit. Also the maximum length of the text message composed from the MOTOTRBO™ radio is 140 characters.

The radio user can scroll through the text message by using the left and right navigation buttons in both editing and viewing mode. The radio user can press and hold the left navigation button to scroll left character by character until the first character in the text message is reached. The radio user can press and hold the right navigation button to scroll right character by character until the last character in the text message is reached. The radio's display panel can only display two lines at a time, therefore if the text message can not fit into two lines, there will be a right arrow displayed at the end of the second line to indicate that more text exists after the second line. A left arrow is displayed at the beginning of the first line to indicate that more text exists before the first line. See Figure 8 for an example.

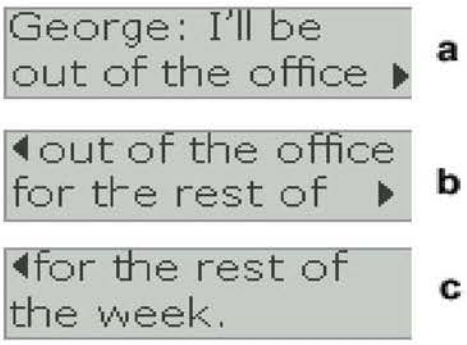


Figure 8 – Example of Text Message Displayed In Multiple Lines

The MOTOTRBO™ radio only supports the UCS2-LE encoding schema. The characters that can be entered through the radio are shown in Figure 9 , which is the MOTOTRBO™ portable's keypad.

Figure 9 – MOTOTRBO™ Portable Keypad

For the received text message as long as the character is supported in Unicode or UCS-2 LE, it can be displayed correctly on the radio so long as the appropriate language pack has been installed via CPS. For example \n will be interpreted as line feed and \r will be interpreted as carriage return.

8 Subject Line Retention

With MOTOTRBO System Release 1.3, the MOTOTRBO portable and mobile radios are capable of supporting a subject line within the body of a Simple Text Message. When replying to or forwarding a text message, the subject line will be retained as part of the Simple Text Message to the recipient.

8.1 Feature Usage

A subject line is an optional field for the Simple Text Message. If a subject line is used, it is embedded as part of the Simple Text Message payload and counts toward the 140 character limit for a text message.

To use this feature, delimit the subject line from the text message body with a CR-LF pair. The CR-LF pair counts as two characters against the 140 character limit for a text message. Only the text preceding the first occurrence of a CR-LF pair is considered the subject line of the text message.

8.2 Special Cases

The following are special cases to consider when utilizing a subject line:

- Only external Text Messaging applications such as the Motorola Text Messaging Server or a 3rd Party Text Messaging Application can utilize the subject line capabilities of a MOTOTRBO™ System Release 1.3 radio. The MOTOTRBO™ CPS is not capable of provisioning a subject line in pre-programmed text messages. Additionally, the radio is not capable of composing a subject line in a new text message; it can only retain a subject line from a text message that is received.

- A CR-LF pair with no preceding text is considered to have a blank subject line. A subject line will not be retained by a MOTOTRBO System Release 1.3 radio when replying to or forwarding a text message.

- A Simple Text Message received without a CR-LF delimiter must be treated as a text message without a subject line. The entire contents of the payload must be treated as a text message body and must not be used when replying to or forwarding a Simple Text Message.

- MOTOTRBO System Release 1.2, or earlier, radios do not support Subject Line Retention. A Simple Text Message received by these radios will not be parsed into a subject line and a text message body. The entire payload will be treated as a text message body and will not be used when replying to or forwarding a Simple Text Message.

9 Use Cases

This section provides some typical use-cases to illustrate the use of the Text Messaging protocol and interoperation between the TMS application and Presence Notifier. Please see Reference [1] for more information.

9.1 TMS Wide Area Success

This scenario illustrates how the MOTOTRBO™ radio (MSU – Mobile Subscriber Unit) powers up on the Radio Network and sends a text message to another subscriber. The TMS server application provides enhanced delivery of the text message.

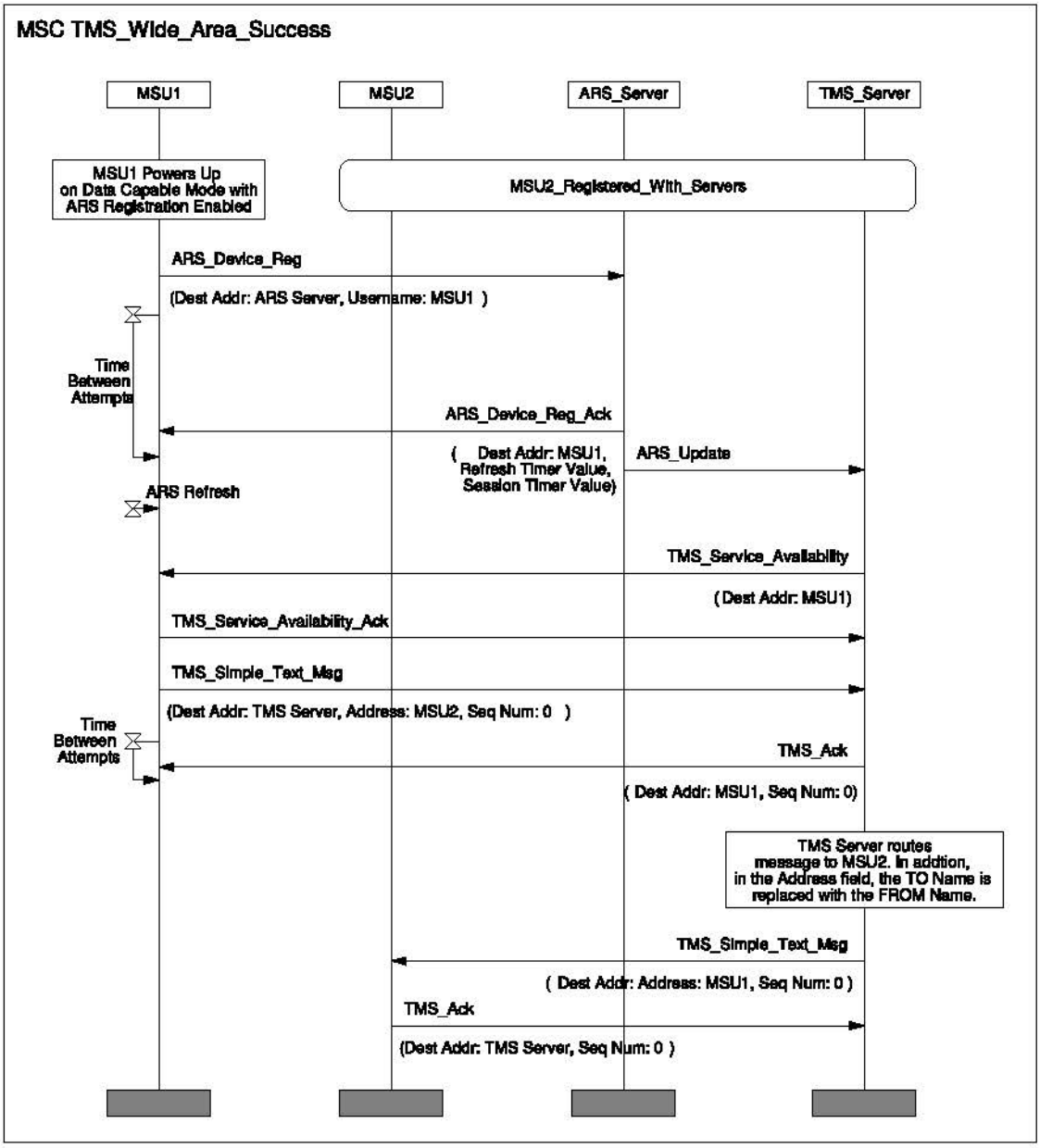


Figure 10 – TMS Wide Area Success

9.2 TMS Wide Area Destination Unavailable

This scenario illustrates how a message is stored in the TMS server when a subscriber is not available and cannot be contacted for message delivery. The TMS server application provides enhanced delivery of the text message. When the target subscriber is not available, the message is stored for later delivery.

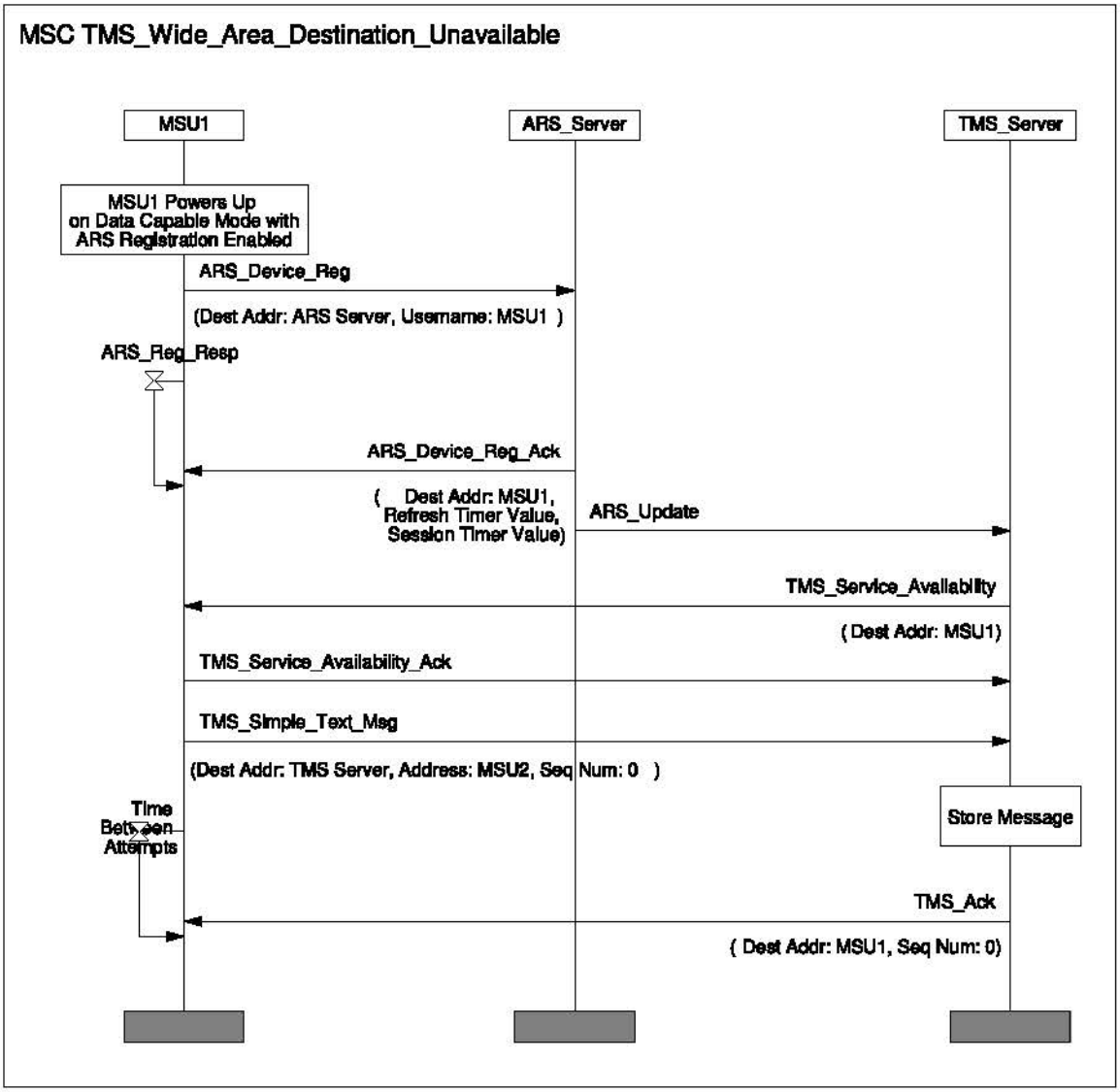


Figure 11 – TMS Wide Area Destination Unavailable

9.3 TMS Wide Area Message Waiting

This scenario illustrates how a subscriber receives messages that are stored in the server when powering up. The TMS server application provides enhanced delivery of the text message. Upon detection of the target subscriber, the TMS server application completes delivery of pending messages.

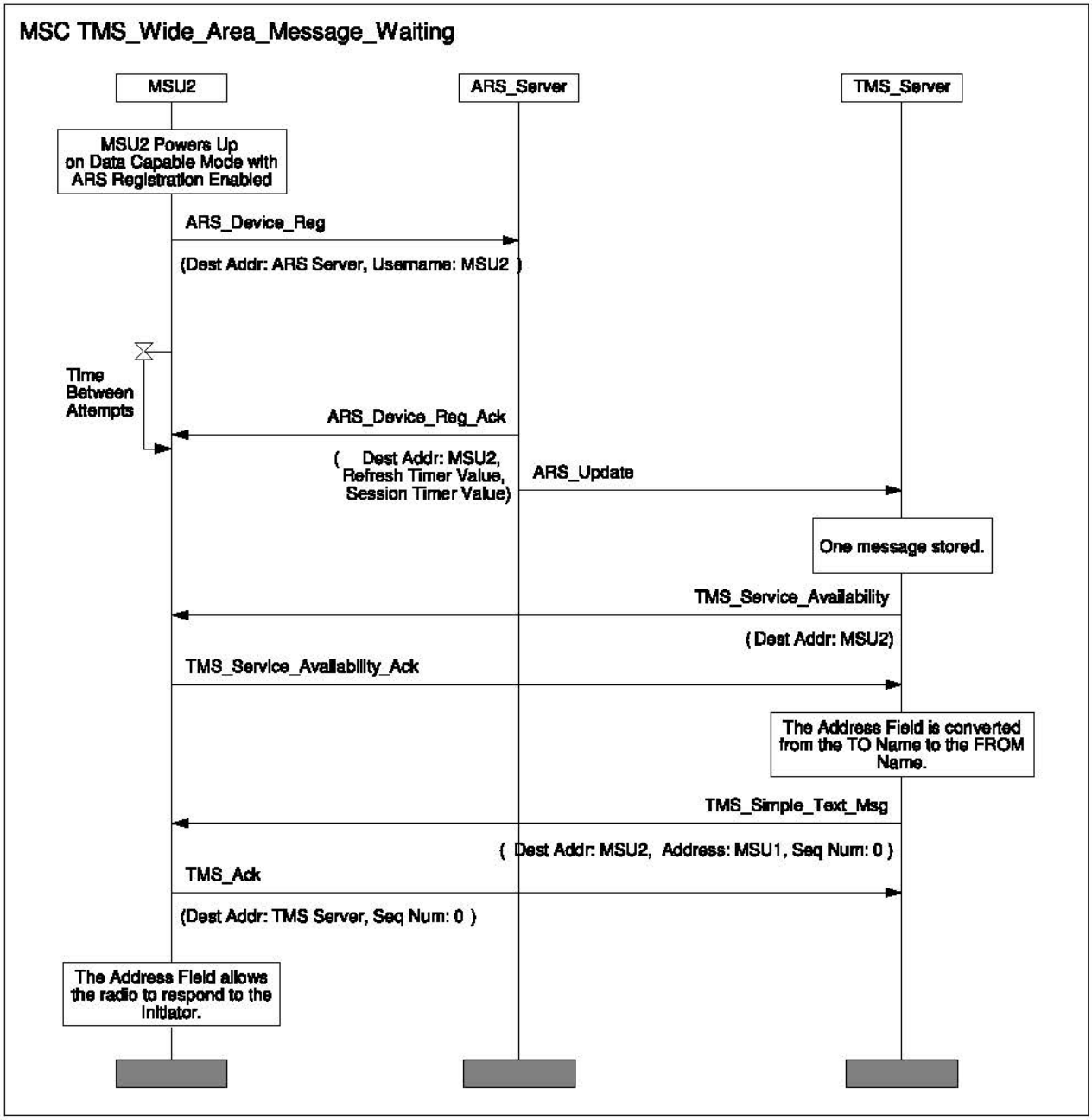


Figure 12 – TMS Wide Area Message Waiting

9.4 TMS Direct Send Success

This scenario illustrates how a message is sent between two subscribers in direct mode (i.e. point-to-point communications in digital RF mode between subscriber units without use of a repeater). Note that MSU1 in this example is a PC-attached MOTOTRBO™ radio functioning as a peer to other subscriber units.

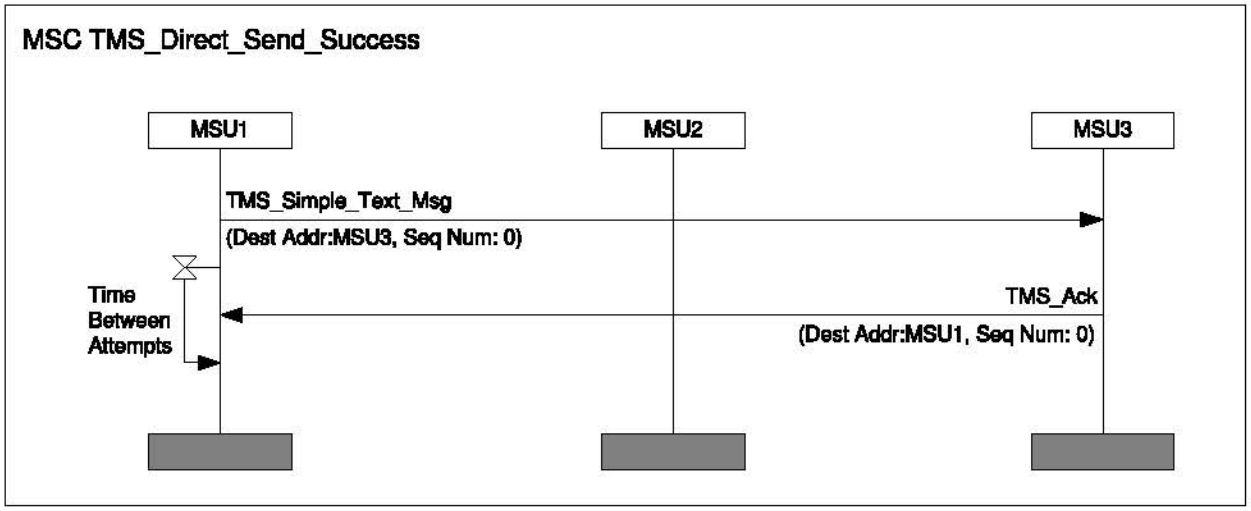
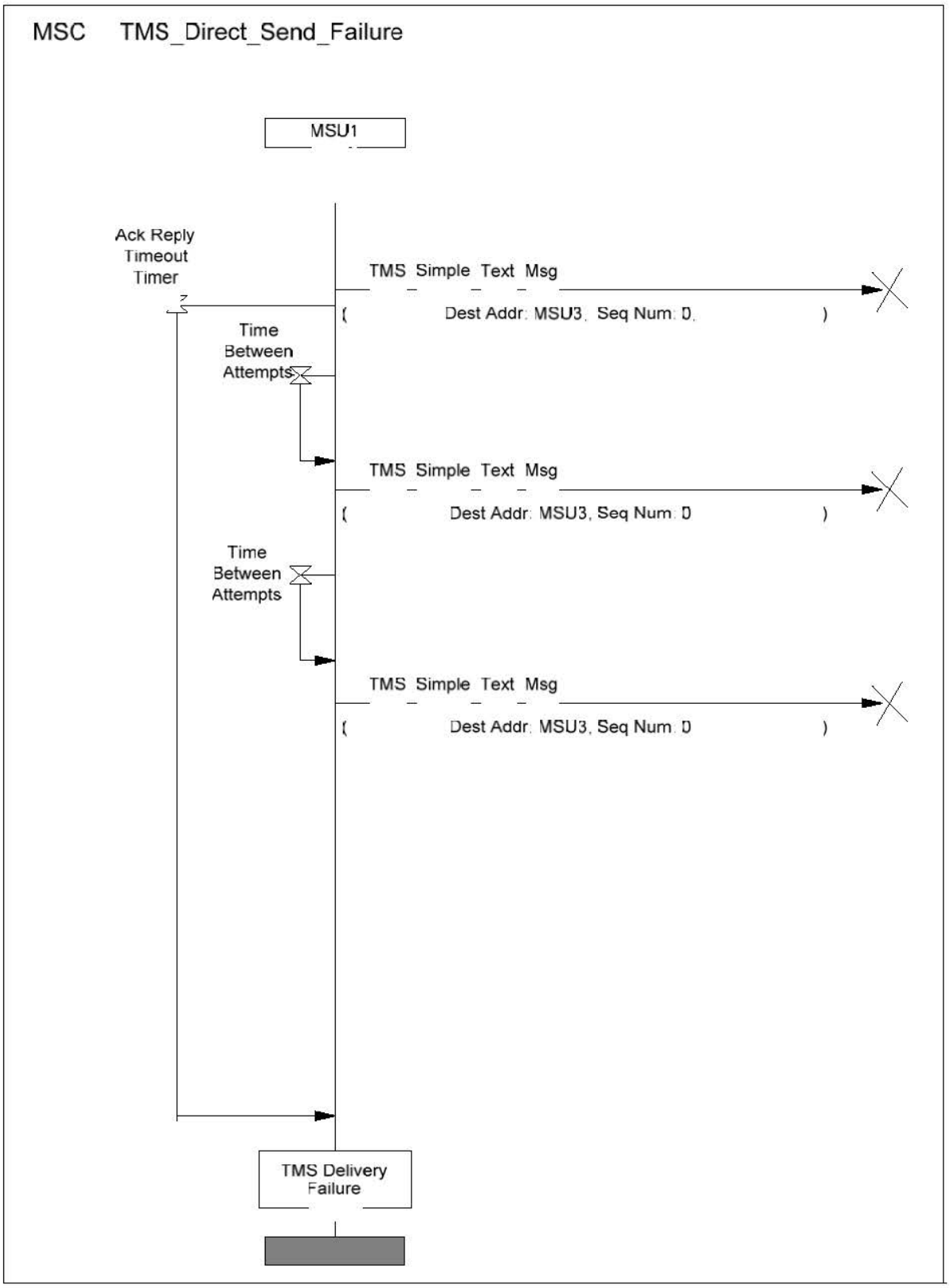


Figure 13 – TMS Direct Send Success

9.5 TMS Direct Send Failure

This scenario illustrates how a message failure occurs if the acknowledgement is not received within predefined period. Note that MSU1 in this example is a PC-attached MOTOTRBO™ radio functioning as a peer to other subscriber units.

When acknowledgement is required, an Ack Reply Timeout Timer at application layer (>= 70 seconds) and a Between Attempts Timer (>=3.4 and <=6.75 seconds) at the data link layer are started. If the acknowledgement is not received before the Between Attempts Timer expires, a maximum of 3 attempts including the original request are conducted with the interval of Between Attempts Timer. An error message will be reported to the application layer or the user after the Ack Reply Timeout Timer expires. It is up to the application implementation to decide if a retry at the application layer should be conducted or not.



509
510

Figure 14 – TMS Direct Send Failure

9.6 TMS Direct Send Group

This scenario illustrates how a message is sent to a subscriber group in direct mode. Note that MSU1 in this example is a PC-attached MOTOTRBO™ radio functioning as a peer to other subscriber units.

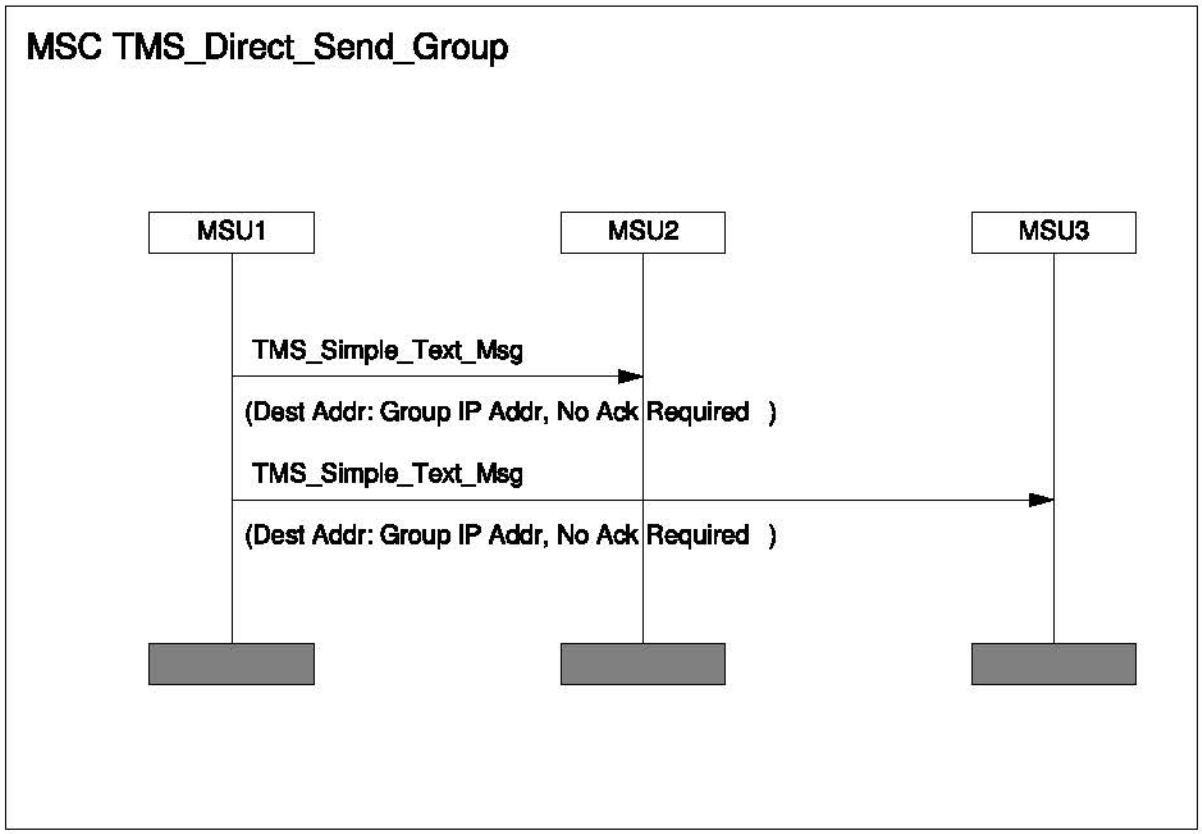


Figure 15 – TMS Direct Send Group

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